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**NASA CONTRACTOR REPORT 166469**

Helicopter Technology Benefits and Needs  
Volume I. Summary

John Zuk  
Richard J. Adams

(NASA-CR-166469-Vol-1) HELICOPTER  
TECHNOLOGY BENEFITS AND NEEDS. VOLUME 1:  
SUMMARY (Systems Control, Inc., West) 34 p  
HC A03/MF A01 CSCL 05A

N83-23240

Unclas  
G3/85 09705

CONTRACT NAS2-10411  
July 1980

**NASA**



NASA CONTRACTOR REPORT 166469

Helicopter Technology Benefits and Needs

Volume I. Summary

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Prepared for  
Ames Research Center  
under Contract NAS2-10411



National Aeronautics and  
Space Administration

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## PREFACE

THE CONTENTS OF THIS DOCUMENT REPRESENT THE CONSENSUS OF PARTICIPANTS IN THE PUBLIC SERVICE HELICOPTER USERS' WORKSHOP HELD AT NASA AMES RESEARCH CENTER, JULY 14 - 16, 1980.

VOLUME I PROVIDES A SUMMARY OF THE WORKSHOP.

VOLUME II PROVIDES THE APPENDICES.

FOR FURTHER INFORMATION ABOUT THE WORKSHOP OR PUBLICATIONS, CONTACT DR. JOHN ZUK, CHIEF, AERONAUTICAL SYSTEMS BRANCH, NASA AMES RESEARCH CENTER, MAIL STOP 237-11, MOFFETT FIELD, CA 94035.

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## WORKSHOP OBJECTIVES

THE PUBLIC SERVICE HELICOPTER HAS BEEN USED SINCE THE 1940S IN MANY LIFE SAVING, PROPERTY SAVING, AND PUBLIC SAFETY ROLES. BECAUSE OF THE HIGH POTENTIAL FOR SIGNIFICANT NATIONAL BENEFITS THROUGH THE APPLICATION OF ADVANCED ROTORCRAFT TECHNOLOGY, NASA HAS SPONSORED A CONTRACT MANAGED (SCI) DETAILED ASSESSMENT STUDY AND WORKSHOP TO:

1. QUANTIFY AND ASSESS PAST AND FUTURE PUBLIC SERVICE GROWTH,
2. DEFINE NEEDS, PROBLEM AREAS, AND DESIRED VEHICLE CHARACTERISTICS,
3. ASSESS PUBLIC SERVICE ROTORCRAFT DESIGN REQUIREMENTS,
4. FORMULATE RESEARCH AND TECHNOLOGY RECOMMENDATIONS, AND
5. ASSESS COSTS AND BENEFITS OF RESEARCH OPTIONS.

## POTENTIAL BENEFITS

OF

### AN ADVANCED PUBLIC SERVICE ROTORCRAFT

ADVANCED TECHNOLOGY ENABLING HIGH SPEED (200 - 300 KNOTS) - MINIMIZING TRANSIT TIME, EFFECTIVE NIGHT, ALL-WEATHER, SAFE, AND RELIABLE OPERATION MAY YIELD THE FOLLOWING POTENTIAL ANNUAL BENEFITS FOR THE VARIOUS MISSIONS:

0	EMERGENCY MEDICAL SERVICES: 40% OF TRAUMA DEATH VICTIMS*	=	\$9.2 BILLION
0	SEARCH AND RESCUE: 10,000 LIVES/YEAR	=	\$2.0 BILLION
0	LAW ENFORCEMENT: 7% OF \$6 BILLION COST OF U.S. CRIME	=	\$ .4 BILLION
0	FIRE FIGHTING: 1% (\$5 BILLION U.S. PROPERTY LOSS)	=	\$ .1 BILLION
	1% (10,000 PEOPLE KILLED/YEAR)	=	\$ .2 BILLION

ANNUAL SAVINGS TO SOCIETY	=	\$ 12 BILLION
---------------------------	---	---------------

ASSUMED VALUE OF HUMAN LIFE = \$200K (NHTSA)

"GIVEN THE ADVANCED TECHNOLOGY ROTORCRAFT, THE PRODUCTIVITY OF EXISTING PUBLIC SERVICE PROGRAMS WOULD INCREASE BY 60%" - WORKING GROUP CHAIRMAN
---

#### ADDITIONAL BENEFITS UNQUANTIFIED:

0	FEWER CENTRALIZED, SPECIALIZED HOSPITALS
0	SECONDARY EFFECTS, LOSS PREVENTION (E.G., FLOODS RESULTING FROM BURIED AREAS)

\* ASSUMES ON-SCENE CARE AND DEFINITIVE CARE FACILITIES IN ADDITION TO ADVANCED TECHNOLOGY ROTORCRAFT. DOES NOT ACCOUNT FOR REDUCTION OF SOCIETAL COSTS DUE TO LESS SEVERE INJURIES.

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## PUBLIC SERVICE HELICOPTER BENEFITS

PUBLIC SERVICE ROTORCRAFT COMPRISE 1/6 OF TOTAL CIVIL FLEET AND ABOUT 1/3 OF CIVIL FLIGHT HOURS.

PUBLIC APPRECIATION OF MISSIONS INCREASES COMMUNITY ACCEPTANCE OF ALL HELICOPTERS AND HELIPORTS

### SEARCH AND RESCUE (SAR)

- 0 HELICOPTER CAN REDUCE RESPONSE TIME BY 80%.
- 0 U.S. HELICOPTERS HAVE AIR LIFTED APPROXIMATELY 800,000 PEOPLE FROM LIFE THREATENING SITUATIONS.
- 0 U.S. COAST GUARD IN 1978: 11,700 HELICOPTER SARS, 1953 LIVES SAVED. PROJECT 25,000 HELICOPTER SARS BY 1985.
- 0 1 CALIFORNIA HIGHWAY PATROL HELICOPTER USED 20% OF TIME FOR RESCUE, SAVED 92 LIVES (CERTIFIED BY DOCTORS) OVER 15 MONTHS. 59/1 RETURN ON INVESTMENT.
- 0 SAN BERNARDINO COUNTY SHERIFF'S OFFICE (CA) 1979: 60 SAR MISSIONS (10% FLIGHT TIME), 24 LIVES SAVED

### EMERGENCY MEDICAL SERVICES (EMS)

- 0 TRAUMA KILLS 115,000 PERSONS/YEAR; COSTS SOCIETY \$41.5 BILLION ANNUALLY.
- 51,900 PEOPLE DIED ON HIGHWAYS IN 1978 (NHTSA)
- MARYLAND STATE POLICE TRANSPORTED OVER 300 PERSONS TO SPECIALIZED STATE MEDICAL CENTERS IN JUNE 1980.
- GROWING SUPPORT FOR REGIONAL STATE SHOCK TRAUMA CENTERS BASED ON HELICOPTER TRANSPORTATION. HELIPORTS AT HOSPITALS HAVE DOUBLED OVER THE LAST 5 YEARS.
- THE HELICOPTER TECHNOLOGY CAN REDUCE RESPONSE TIME BY AS MUCH AS 80% AND REDUCE MORTALITY BY 50%.

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PUBLIC SERVICE HELICOPTER BENEFITS

LAW ENFORCEMENT AND PUBLIC SAFETY

For 1% OF POLICE BUDGET, HELICOPTERS PROVIDE:  
0 7% CRIME REDUCTION (BURGLARY, ROBBERY, THEFT, AUTO THEFT)

HELICOPTER COMPARED TO PATROL CAR:  
0 SURVEYS 30 TIMES MORE AREA  
0 5 TO 10 TIMES FASTER RESPONSE RATE  
0 2 TO 6 TIMES HIGHER APPREHENSIONS  
0 UP TO 10 TIMES OPERATIONAL COST RECOVERY (STOLEN GOODS)  
0 INCREASED SAFETY FOR GROUND PATROLMEN

DISASTER RELIEF

0 ONLY METHOD AVAILABLE IN MANY CASES  
0 9000 PEOPLE SAVED - TAMPICO FLOODS  
0 7000 PEOPLE SAVED - HURRICANE ANITA  
0 PROVIDE ADDITIONAL UTILITY SERVICES TO EASE DISTRESS

FIRE PROTECTION

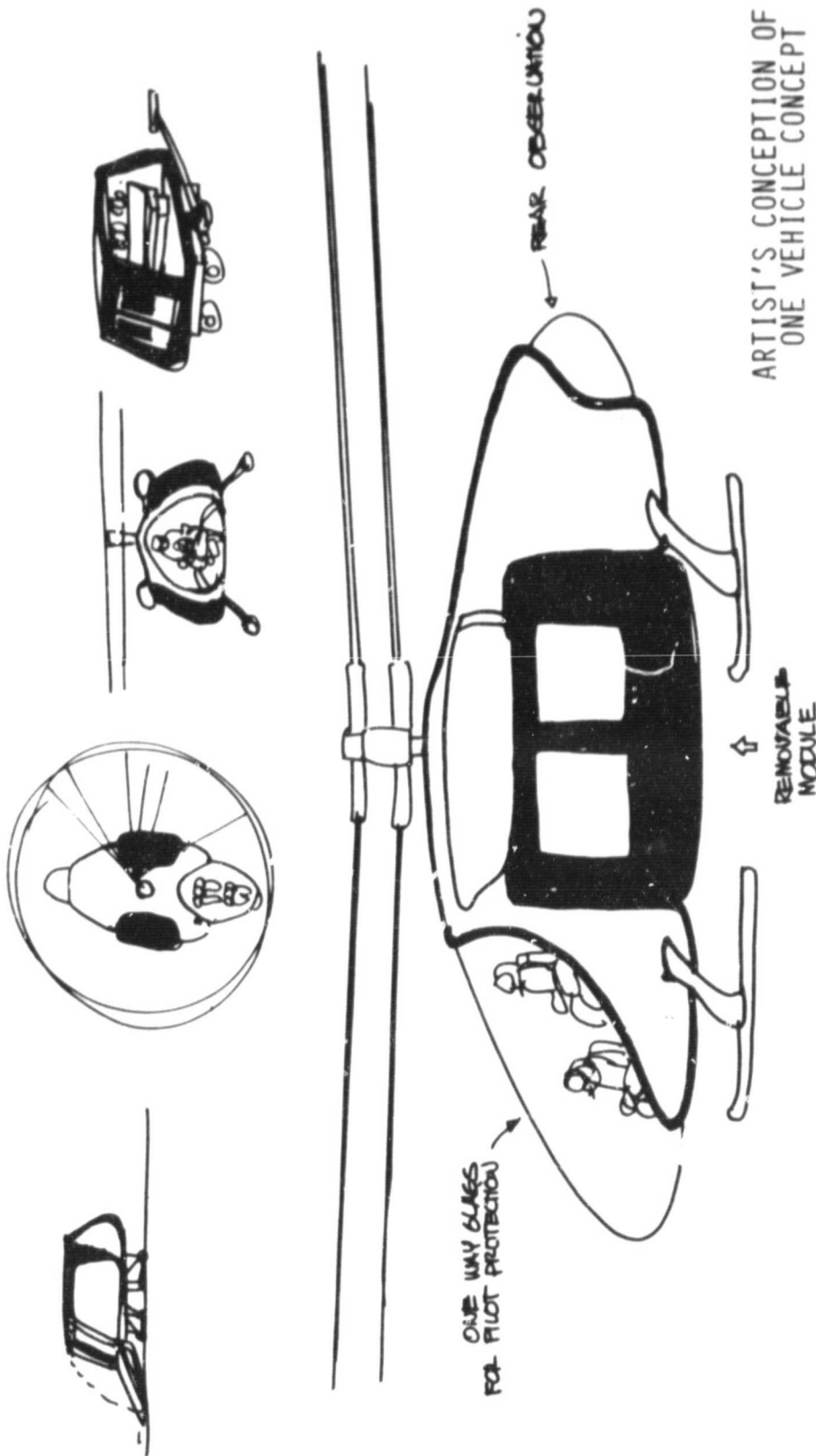
0 HELICOPTERS ASSIST IN FIGHTING APPROXIMATELY 9000 FIRES/YEAR IN CALIFORNIA ALONE  
0 OVER 4000 HIGH RISE FIRES PER YEAR - 2500 ABOVE 100 FT WHERE CONVENTIONAL GROUND EQUIPMENT CAN'T REACH  
0 HELICOPTERS COMPARED TO FIXED WING:  
- HELICOPTERS CAN DELIVER TWICE THE RETARDANT TO THE FIRE  
- PRECISELY DELIVER WATER TO DIRECTLY SUPPRESS THE FIRE  
- MORE VERSATILE (DELIVER MEN, TOOLS, ETC.)

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THERE IS A STRONG PROBABILITY THAT ONE AIRCRAFT  
WITH MODULAR CAPABILITIES MAY BE SUITABLE FOR  
ALL FOUR PUBLIC SERVICE MISSION AREAS - WORKING

GROUP CHAIRMAN CONSENSUS

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ARTIST'S CONCEPTION OF  
ONE VEHICLE CONCEPT

# SUMMARY OF NEW VEHICLE SPECIFICATIONS

CABIN SIZE		NAV/GUIDANCE	SAFETY	PROPULSION
200 KNOTS MAX CONTINUOUS	MODULAR	IFR CAPABILITY	CRASHWORTHY STRUCTURE	MULTIPLE
300 DASH 30 MIN MAX	2-4 CREW (BY MISSION)	ALL-WEATHER CAP-ABILITIES	CRASHWORTHY SEATS	FUEL CAPABILI
4 HOUR ENDURANCE	2-6 PASSENGERS	MORE AUTOMATION/LESS WORKLOAD	CRASHWORTHY FUEL SYSTEMS	NON-PETRO FUEL CAPABILITY
10000' HOGE (SINGLE ENGINE)	2+ LITTERS	REDUCED NOISE & VIBRATION	IMPROVED HOISTS	EMERGENCY POWER CAPABILITY
20000' HIGE (SINGLE ENGINE)	INTERNAL MOBILITY	IMPROVED SEAT COMFORT	IMPROVED VISIBILITY	
10000 LB MAX G.W.	ALL TERRAIN LANDING			
20' ROTOR DIAMETER (MAX)				

### WORKSHOP ORGANIZATION

THIS WORKSHOP WAS SPONSORED BY SYSTEMS CONTROL, INC. (VT.) FOR NASA UNDER CONTRACT NAS2-10411. THE WORKSHOP WAS HELD ON 14, 15 AND 16 JULY 1980.

THE WORKSHOP WAS ORGANIZED INTO TECHNOLOGY REVIEW SESSIONS, OPERATOR AND MANUFACTURER OVERVIEW SESSIONS, WORKING GROUPS AND A TOUR OF NASA AMES. IN THE TECHNOLOGY SESSIONS, NASA ENGINEERS PROVIDED UP-TO-DATE INFORMATION ON CURRENT TECHNOLOGY AND THE PROMISING NEW TECHNOLOGY. THE OPERATOR AND MANUFACTURER OVERVIEWS WERE PRESENTED BY REPRESENTATIVES FROM THE HELICOPTER ASSOCIATION OF AMERICA, THE AMERICAN HELICOPTER SOCIETY, AND THE AIRBORNE LAW ENFORCEMENT ASSOCIATION. THE WORKING SESSIONS WERE ORGANIZED ALONG LINES OF MAJOR MISSIONS IN THE FIELDS OF:

- 0 SEARCH AND RESCUE
- 0 EMERGENCY MEDICAL SERVICE
- 0 LAW ENFORCEMENT AND PUBLIC SAFETY
- 0 ENVIRONMENTAL CONTROL AND FIRE FIGHTING

THESE WORKING SESSIONS WERE USED TO FORMULATE THE PUBLIC SERVICE HELICOPTER TECHNOLOGY NEEDS REQUIRED TO PERFORM THEIR RESPECTIVE MISSIONS. THE IDENTIFIED NEEDS ARE SUMMARIZED IN THIS REPORT.

THE DETAILED WORKSHOP AGENDA IS PRESENTED IN APPENDIX A.

KEYNOTE SPEAKERS

HELICOPTER ASSOCIATION OF AMERICA (HAA)

MR. GLEN A. GILBERT

WORKING GROUP CHAIRMEN

LAW ENFORCEMENT AND PUBLIC SAFETY

LIEUTENANT ROBERT MORRISON, HUNTINGTON BEACH  
POLICE DEPARTMENT (HBPD)

AMERICAN HELICOPTER SOCIETY (AHS)

MR. THOMAS STUELPNAGEL

EMERGENCY MEDICAL SERVICES (EMS)

OFFICER EARL BUTCH CROGIN, U.S. PARK SERVICE

AIRBORNE LAW ENFORCEMENT ASSOCIATION (ALEA)

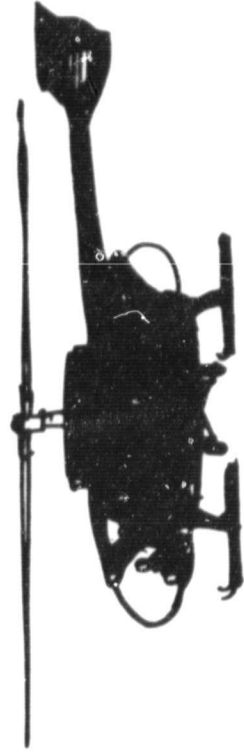
LIEUTENANT ROBERT MORRISON

SEARCH AND RESCUE (SAR)

CAPTAIN TERRY JAGERSON, SAN BERNARDINO S.O.

ENVIRONMENTAL CONTROL AND FIRE FIGHTING

MR. DON ROMINGER, CALIFORNIA DEPARTMENT OF  
FORESTRY



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HELICOPTER ASSOCIATION OF AMERICA COMMENTS - PRESENTED BY GLEN GILBERT

BEGINNING THE DECADE OF THE 80s, THE HELICOPTER INDUSTRY IS GROWING AT THE RATE OF 12 TO 15%. THE U.S. CIVIL FLEET NOW NUMBERING 8000 SHOULD EXCEED 20,000 BY THE END OF THE DECADE. PUBLIC SERVICE HELICOPTERS, WHICH NOW NUMBER ONLY 1200, SHOULD EXCEED 3000 AT THE END OF THE SAME TIME PERIOD. CONTINUING THIS INDUSTRY GROWTH RATE WILL DEPEND ON A NUMBER OF FACTORS. TWO IMPORTANT FACTORS INTERACT WITH PUBLIC SERVICE HELICOPTERS.

1. OBTAINING COMMUNITY ACCEPTANCE OF HELICOPTERS - THE PUBLIC APPRECIATES THE PUBLIC SERVICE MISSIONS, AND IN THE FUTURE, INCREASING SERVICES WILL INCREASE COMMUNITY AWARENESS AND ACCEPTANCE OF ALL HELICOPTERS.
2. PROVIDING MORE HELIPOINTS - SORELY NEEDED ARE PUBLIC USE HELIPOINTS TO ENABLE CITY CENTER-TO-CITY CENTER INTER-URBAN TRANSPORT. THE INCREASING VISIBILITY OF PUBLIC SERVICE HELICOPTERS WILL GREATLY AID IN APPROVING CITY CENTER HELIPOINTS.

THE MANUFACTURER'S VIEWPOINT, PRESENTED BY MR. TOM STUELPNAGEL

PUBLIC SERVICE HELICOPTERS CURRENTLY COMPRISE ABOUT ONE-SIXTH OF THE TOTAL NUMBER OF HELICOPTERS FLYING IN THE U.S. HOWEVER, THE PUBLIC SERVICE HELICOPTERS FLY TWICE AS MANY HOURS, ON THE AVERAGE, AS COMMERCIAL HELICOPTERS. THEREFORE, THE PUBLIC SERVICE USERS ACCOUNT FOR AS MUCH AS 1/3 OF THE CIVIL FLIGHT HOURS. IN ADDITION, THE GROWTH RATE IN THIS SECTOR IS RISING AT TWICE THE RATE OF OTHER USERS. EVEN WITH ALL OF THESE POSITIVE INFLUENCES, THE MANUFACTURER CAN ONLY REALIZE NEW SHIP SALES TO THE PUBLIC SERVICE SECTOR OF ABOUT 5-10% SINCE SO MANY OF THE HELICOPTERS ARE SURPLUS OR USED. THIS TOTAL NEW SALES MARKET OF FROM 5-10% IS A VERY DIFFICULT ONE FROM A PROFITABILITY VIEWPOINT SINCE ALMOST NO HELICOPTER GOES OUT THE SAME IN THE PUBLIC SERVICE MARKET. FOR THESE REASONS, IT IS NECESSARY TO DEFINE AN ALTERNATIVE PATH IN ORDER TO SATISFY THE TECHNOLOGY NEEDS OF THE PUBLIC SERVICE HELICOPTER USERS. FIRST, THE USERS MUST ORGANIZE AS A GROUP AND APTLY EXPRESS THE REQUIREMENTS AND THE DESIRE TO FILL THOSE REQUIREMENTS. SECONDLY, THE USERS MUST COMPILE A DATA BASE TO JUSTIFY THOSE NEEDS IN TERMS OF LIVES AND PROPERTY SAVED. FINALLY, A MEANS MUST BE FOUND TO UTILIZE THE EXPERTISE AND HIGH TECHNOLOGY AID AVAILABLE FROM NASA. THAT'S A VERY IMPORTANT FEATURE OF THE FUTURE. WE HOPE THAT IT CAN INCLUDE TECHNOLOGY. THIS TECHNOLOGY MAY GO TO THE MANUFACTURERS AND COME BACK TO YOU THAT WAY. IT MAY INCLUDE THE SPONSORSHIP OF A PUBLIC SERVICE HELICOPTER".

AIRBORNE LAW ENFORCEMENT ASSOCIATION OVERVIEW OF

LAW ENFORCEMENT ROLES FOR ROTORCRAFT - LT. ROBERT MORRISON

THE EXPANDED USE OF HELICOPTERS AS A TOOL FOR LAW ENFORCEMENT WAS FIRST DEMONSTRATED IN 1966 WHEN THE L.A. COUNTY S.O. INITIATED "OPERATION SKYKNIGHT". THIS STUDY PROVIDED SUFFICIENT PROOF THAT HELICOPTERS, MANNED BY TRAINED POLICE OFFICERS, COULD GREATLY ENHANCE THE SAFETY AND ABILITIES OF THE "MAN-ON-THE-BEAT" IN HIS EFFORTS TO COMBAT CRIME.

THROUGH THE NEXT 15 YEARS, PUBLIC SERVICE AGENCIES ACROSS THE NATION EXPERIMENTED AND DEVELOPED NEW USES OF THE HELICOPTER TO THE POINT THAT IT BECAME AN INDISPENSABLE TOOL. NEW TECHNIQUES CREATED ADDITIONAL DEMANDS FOR SERVICES. FLIGHT HOURS EXCEEDED MILITARY UTILIZATION OF THE SAME EQUIPMENT, AND DESIGN LIMITATIONS OF THE VARIOUS HELICOPTERS USED WERE QUICKLY REACHED.

PRESENT DAY NEEDS REQUIRE EXTENSIVE MODIFICATION OF HELICOPTERS THAT WERE NOT DESIGNED FOR THE MULTIPURPOSE MISSIONS REQUIRED BY PUBLIC SERVICE AGENCIES. TO THIS END, IT IS THE VIEW OF THE ALEA, INC., THAT NASA IS THE LOGICAL AGENCY TO ASSUME THE DESIGN AND DEVELOPMENT ROLE, UP THROUGH A PROTOTYPE, OF THE FUTURE NEEDS OF AIRBORNE PUBLIC SERVICE AGENCIES. THESE NEEDS, BOTH SHORT AND LONG TERM, WOULD THEN BE PRESENTED TO THE MANUFACTURERS WHO ARE RELUCTANT TO UNDERWRITE THESE R&D COSTS BECAUSE OF THEIR PRESENT DAY LIMITED MARKET PROJECTIONS.

KEY MISSION DATA

SAR

EMS

0 U.S. COAST GUARD	0 TRAUMA KILLS 115,000 PERSONS/YR
78,000 CALLS FOR ASSISTANCE, 4300 LIVES SAVED	0 TRAUMA COSTS SOCIETY \$41.5 BILLION ANNUALLY
11,700 HELICOPTER SARs, 1953 LIVES SAVED	0 ACCIDENTS ARE LEADING CAUSE OF DEATH FOR PEOPLE LESS THAN 38 YEARS OLD
PROJECTED 25,000 HEL. SARs BY 1990	0 ACCIDENTS HOSPITALIZE 10.2 MILLION PEOPLE/YEAR FOR ONE DAY OR MORE
0 SWISS AIR RESCUE	0 1 OUT OF EVERY 8 BEDS IN GENERAL HOSPITALS ARE OCCUPIED BY TRAUMA VICTIMS
DOUBLED RESCUES SINCE 1975	0 50% OF ALL ACCIDENTAL DEATHS ARE DUE TO THE AUTOMOBILE
PERFORMED 3,482 SARs	0 RURAL ACCIDENTAL DEATH RATE IS 4 TIMES URBAN
TRANSPORTED 3,242 PERSONS	0 51,900 PEOPLE DIED ON HIGHWAYS IN 1978
0 COUNTY AGENCY	0 THE HELICOPTER CAN REDUCE RESPONSE TIME 3Y AS MUCH AS 80%
71 TAKEOFFS	0 THE HELICOPTER CAN REDUCE MORTALITY AND MORBIDITY BY 50%
60 PICKUPS	
85 TRANSPORTS	
24 LIVES SAVED	
28% SURVIVABILITY	



KEY MISSION DATA

LAW ENFORCEMENT AND PUBLIC SAFETY	FIRE FIGHTING
o \$6 BILLION COST OF CRIME IN U.S.	o 8621 DEATHS, 1978
(BURGLARY, ROBBERY, THEFT, AUTO THEFT)	o \$1.95 BILLION ANNUALLY
o 7% AVERAGE REDUCTION IN CRIME USING	o 32023 PEOPLE INJURED
HELICOPTER PATROL FOR ABOUT 1% OF	o OVER \$5 BILLION IN LOST PROPERTY

POLICE BUDGET

o \$.4B ANNUAL SAVINGS POTENTIAL NATION-  
WIDE USING HELICOPTER PATROL

o HELICOPTER COMPARED TO PATROL CAR:  
SURVEYS 30 TIMES MORE AREA  
5 TO 10 TIMES FASTER RESPONSE RATE  
FLYS 3 TIMES FASTER

WHAT ARE THE PUBLIC SERVICE HELICOPTER USES?

0 LAW ENFORCEMENT & PUBLIC SAFETY

0 MEDICAL SERVICES

A. LAW ENFORCEMENT:

1. DRUG ENFORCEMENT & DETECTION
2. SECURITY (BUILDINGS & VIPs)
3. SURVEILLANCE (GENERAL & COVERT)
4. SEARCH (FUGITIVES & VEHICLES)
5. PATROL
6. OBSERVATION POST
7. HIGH SPEED PURSUIT
8. COMMAND POST
9. CROWD CONTROL (TRAFFIC & RIOTS)
10. POLLUTION CONTROL
11. TRANSPORT (VIPs & CRIME SPECIALISTS)

B. PUBLIC SAFETY:

1. AMBULANCE ESCORT
2. DISASTER WARNING & RELIEF
3. EMERGENCY CARGO TRANSPORT
4. FIRE DETECTION
5. RESCUE
6. SEARCH (PEOPLE LOST)
7. TRAFFIC (EMERGENCY)
8. WATER AREA PATROL
9. AERIAL PHOTOGRAPHY

A. EMERGENCY MEDICAL SERVICES:

1. AT THE SCENE ACCIDENT PICK-UPS
  - A. TRAFFIC
  - B. OCCUPATIONAL
  - C. RESIDENTIAL
  - D. RECREATIONAL
2. INTERHOSPITAL TRANSFERS
  - A. CRITICAL PATIENT TRANSFER
  - B. NEONATAL TRANSFER
  - C. BURN PATIENT TRANSFER
  - D. ORGAN/BLOOD TRANSPORT
  - E. MEDICAL SUPPLY TRANSPORT
  - F. MEDICAL EQUIPMENT TRANSPORT

B. SEARCH AND RESCUE:

1. MOUNTAIN REMOTE SITE RESCUE
2. OCEAN/RIVER RESCUE
3. MISSING OR LATE VESSELS
4. SHIP COLLISIONS AND GROUNDINGS
5. MISSING PERSONS
6. STOLEN PROPERTY RECOVERY
7. AIRCRAFT ACCIDENTS
8. ENDANGERED FIRE FIGHTING PERSONNEL

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# WHAT ARE THE PUBLIC SERVICE HELICOPTER USES?

## O ENVIRONMENTAL CONTROL

### A. WILDLIFE MANAGEMENT:

1. HERDING ANIMALS
2. TAGGING ANIMALS
3. RELOCATING ANIMALS
4. DAMAGE CONTROL
5. FISH STOCKING
6. FISH MANAGEMENT
7. SPRAYING INSECTICIDE

### B. SURVEYS:

1. ANIMAL & FISH POPULATION
2. INSPECT OIL PLATFORMS
3. INSPECT STRIP MINES
4. INSPECT POWER LINES
5. INSPECT DAMS & RESERVOIRS
6. AERIAL PHOTOGRAPHY
7. FACTORY POLLUTION MONITORING
8. WETLANDS INSPECTION

### C. EXTERNAL LOADS:

1. TOWER & POLE SETTING
2. WIRE STRINGING
3. PIPELINE LAYING
4. LIMING LAKES
5. SEEDING FORESTS
6. REMOTE SITE CONSTRUCTION
7. REMOTE SITE SUPPLY
8. SNOODING

### D. LAND MANAGEMENT:

1. FIRE CONTROL
  - A. BUREAU OF LAND MANAGEMENT
  - B. U.S. FOREST SERVICE
  - C. BUREAU OF INDIAN AFFAIRS
2. GEOLOGICAL STUDIES
  - A. EXPLORATION
  - B. EARTHQUAKE RESEARCH
  - C. VOLCANO RESEARCH
  - D. CHANNEL MONITORING
3. CADASTRAL SURVEYS
4. ELECTRONIC SURVEYS
5. RESOURCE MANAGEMENT

### E. TRANSPORTATION

1. INSPECTION
2. WORK CREWS
3. SURVEY EQUIPMENT
4. SURVEY PERSONNEL
5. RESUPPLY
6. SEARCH & RESCUE

## O FIRE FIGHTING

### A. TRANSPORT PERSONNEL:

1. FIRE CREWS
2. COMMAND POST
3. FIRE FIGHTING TOOLS, HARDWARE, & SUPPLIES
4. SUSPENDED MANEUVERING SYSTEM

### B. RETARDENT APPLICATIONS

### C. RECONNAISSANCE

1. MAPPING
2. IR SENSING
3. DRY SEASON SURVEILLANCE

### D. BACKFIRING

### O DISASTER RELIEF

### A. LIFESAVING PEOPLE TRANSPORT

### B. LIFE SUSTAINING SUPPLY TRANSPORT

### C. EVACUATION

### D. EARLY WARNING & RESPONSE

### E. COMMAND POST

### F. POST DISASTER CLEAN-UP

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## PROFILES OF THE MISSION

### LAW ENFORCEMENT AND PUBLIC SAFETY - Lt. ROBERT MORRISON

IN THE APPREHENSION OF A CRIMINAL WHILE IN THE ACT OF COMMITTING AN OFFENSE, SPEED IS OF THE ESSENCE. THE PRESIDENT'S COMMISSION OF LAW ENFORCEMENT AND ADMINISTRATION OF JUSTICE REPORTS: "THERE IS A CORRELATION BETWEEN RESPONSE TIME - THE SPEED WITH WHICH POLICE CAN ARRIVE AT A CRIME SCENE - AND APPREHENSION". GIVEN THIS POSITIVE CORRELATION, REDUCED RESPONSE TIME TRANSLATES DIRECTLY INTO THE INCREASED APPREHENSION OF CRIMINALS.

MOST CRIME IS ATTEMPTED OR COMMITTED BECAUSE OF THE PERPETRATOR'S BELIEF IN HIS LIKELIHOOD OF SUCCESS. THIS IS ESPECIALLY TRUE IN THE CRIMES OF BURGLARY, ROBBERY, THEFT AND AUTO THEFT.

IT IS WELL DOCUMENTED THAT THE FASTER THE RESPONSE TIME OF LAW ENFORCEMENT PERSONNEL TO THE SCENE OF A CRIME, THE GREATER THE CHANCES OF APPREHENSION OF THE CRIMINAL SUSPECT.

HELICOPTER UTILIZATION BY LAW ENFORCEMENT HAS PROVED TO BE THE NECESSARY TOOL FOR PROVIDING SWIFT AND SAFE RESPONSE TO THE SCENE OF CRIME AND THUS INCREASES THE LIKELIHOOD OF SUCCESS OF THE POLICE MISSION - PROTECTION OF LIFE AND PROPERTY.

USING THE VALUES PLACED ON THESE INDIVIDUAL CRIMES BY THE FBI, WHICH WAS \$5.4B FOR 1978\*, STUDIES\*\* COMPILED FROM AGENCIES IN THE U.S. WHO USE HELICOPTERS INDICATES AN AVERAGE REDUCTION IN THESE CRIMES OF 6.8%.

BEING ULTRA-CONSERVATIVE TO ALLOW FOR ANY MARGIN OF ERROR, HALF OF THIS PERCENTILE FIGURE TRANSLATES INTO AN ANNUAL SAVINGS TO THE TAXPAYERS OF \$.4B IF HELICOPTERS WERE UNIFORMLY USED ACROSS THE NATION BY LAW ENFORCEMENT AGENCIES.

#### \* 1978 FBI UNIFORM CRIME REPORTS

\*\* (1) AERIAL SURVEILLANCE METHODS OF CRIME PREVENTION; EVALUATION, MAY 1968 BY INSTITUTE FOR POLICE STUDIES, DEPT. OF CRIMINOLOGY, CA STATE COLLEGE, LONG BEACH, P. 93. (2) CITY OF HUNTINGTON BEACH, CALIFORNIA, "HELICOPTER COST EFFECTIVE SURVEY 1973". (3) EFFECTIVENESS OF POLICE HELICOPTER PATROL; FIELD RESEARCH STUDY, CITY OF LONG BEACH, CA, JAN. 1970, PGS 10-17. (4) THE UTILIZATION OF HELICOPTERS FOR POLICE AIR MOBILITY, NATIONAL INSTITUTE OF LAW ENFORCEMENT AND CRIMINAL JUSTICE, U.S. DEPT. OF JUSTICE - LEAA, FEB. 1971, PGS 25 & 26.

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## PROFILES (CONTINUED)

### EMERGENCY MEDICAL SERVICES - OFFICER EARL CRONIN

ACCIDENTS ARE THE LARGEST CAUSE OF DEATH FOR THOSE UNDER 38. THE COST TO SOCIETY EACH YEAR IS \$62 BILLION. 10.2 MILLION PEOPLE EACH YEAR ARE HOSPITALIZED FOR ONE DAY OR MORE, WHICH IS ONE OUT OF EVERY EIGHT HOSPITAL BEDS.

THE CHALLENGE: TO SUSTAIN THE LIFE FUNCTIONS OF THE TRAUMA VICTIM.

THE CHALLENGE: TRANSPORT THE TRAUMA VICTIM TO A REGIONAL TRAUMA FACILITY WHERE THE VICTIM WILL RECEIVE DEFINITIVE CARE FROM A HIGHLY SKILLED TRAUMA STAFF WITH THE AID OF A SPECIALLY DESIGNED AND EQUIPPED FACILITY.

THE CHALLENGE: TO REDUCE SIGNIFICANTLY THE TIME OF TRANSPORT; FOR TIME IS THE ENEMY OF THE TRAUMA VICTIM.

THE CHALLENGE: TO TRANSPORT THE VICTIM IN ALL TYPES OF WEATHER CONDITIONS AT ANY HOUR.

THE CHALLENGE: TO TRANSPORT THE VICTIM IN A MANNER INDEPENDENT OF CONVENTIONAL ROADWAYS WHICH ARE OFTEN CONGESTED.

THE CHALLENGE: TO TRANSPORT THE TRAUMA VICTIM FROM AN URBAN OR RURAL ENVIRONMENT.

HOW ARE THESE CHALLENGES MET? THE HELICOPTER, WHICH HAS BECOME AN IMPORTANT PART OF THE EMERGENCY MEDICAL SYSTEM, MEETS ALL OF THESE CHALLENGES.

THE HELICOPTER WITH A SKILLED CREW CAN MAINTAIN THE TRAUMA VICTIM'S LIFE FUNCTIONS WITH ADVANCED LIFE SUPPORT EQUIPMENT. THIS COMBINATION HAS PROVED INVALUABLE IN THE FIRST FEW MINUTES OF CARE.

A NEED FOR AN ADVANCED ROTORCRAFT WAS IDENTIFIED BY THE EMS WORKING GROUP TO PROVIDE THE ABILITY TO DELIVER ITS CREW AT HIGH SPEED (300 KNOTS) DIRECTLY TO AN URBAN ROADWAY OR RURAL AREA WITHOUT BEING AFFECTED BY ROADWAY TRAFFIC, AND NOT BEING LIMITED BY DARKNESS, RAIN, OR SNOW.

WITH ROTORCRAFT OF ADVANCED DESIGN AND SPEED, ACCIDENT RESPONSE TIME CAN BE REDUCED BY AS MUCH AS 80% AND MORTALITIES BY 50% IN BOTH TRAUMA AND HIGH RISK NEONATES.

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## PROFILES (CONTINUED)

### SEARCH AND RESCUE - CAPT. TERRY JAGERSON

A PRIMARY FUNCTION OF GOVERNMENTS IN OUR SOCIETY IS TO PROTECT LIFE AND PROPERTY. THE ROLE OF SEARCH AND RESCUE IS TO LOCATE INJURED AND/OR LOST PERSONS, EXTRICATE THEM FROM HAZARDOUS ENVIRONMENTS AND, IF NECESSARY, TRANSPORT TO ADEQUATE MEDICAL CARE. MOST OF THESE EMERGENCY LIFE SAVING FUNCTIONS OCCUR IN REMOTE OR UNPOPULATED AREAS AND INCLUDE.

1. LOST AND/OR CRASHED AIRCRAFT
2. LOST AND/OR INJURED PERSONS
3. RIVER, LAKE, AND OCEAN RESCUES
4. MOUNTAIN, ICE AND SNOW RESCUES
5. MINE SHAFT AND DESERT SEARCHES
6. FLOOD RELATED RESCUES
7. INDUSTRIAL AND ROOFTOP RESCUES.

THOUSANDS OF SEARCHES AND RESCUES ARE PERFORMED EACH YEAR BY FEDERAL, STATE, COUNTY, MUNICIPAL, AND PRIVATE ORGANIZATIONS. A REALISTIC GOAL OF PROponents OF SEARCH AND RESCUE ORGANIZATIONS IS TO SAVE LIVES.

PAST HISTORY DEMONSTRATES THAT FUTURE INCREASES IN LEISURE TIME WILL ALSO INCREASE THE NUMBER OF PERSONS WHO WILL NEED EMERGENCY ASSISTANCE AS A RESULT OF GREATER PARTICIPATION IN RECREATIONAL ACTIVITY. FROM AN ECONOMIC AND HUMANISTIC PERSPECTIVE, IT IS IN THE BEST INTEREST OF THE NATION TO PROVIDE AGGRESSIVE SUPPORT OF INCREASED SEARCH AND RESCUE CAPABILITY. ROTARY WING OR VERTICAL LIFT AIRCRAFT ARE ACKNOWLEDGED AS THE MOST EFFICIENT METHOD OF CONDUCTING SEARCH AND RESCUE MISSIONS WITHIN THE NATION'S CONTINENTAL LIMITS.

EFFORTS AND FUNDING OF AIRCRAFT DESIGNED TO MEET SEARCH AND RESCUE NEEDS WILL RETURN AMPLE DIVIDENDS IN FISCAL AND HUMAN TERMS.

WORKSHOP WORKING GROUP MEMBERS ARE CONFIDENT THAT ADVANCED ROTORCRAFT CAN BE DESIGNED TO MEET THE NEEDS OF MANY OF THESE PUBLIC SERVICE MISSIONS. ONE OR POSSIBLY TWO NEW DESIGNS WILL LIKELY SATISFY THESE NEEDS. IT IS HIGHLY PROBABLE THAT OTHER CIVIL AND MILITARY HELICOPTER OPERATIONS WOULD ALSO FIND USES FOR THESE NEW DESIGNS. SINCE THE BENEFITS TO BE GAINED ARE TO THE TAX PAYING PUBLIC, IT IS APPROPRIATE THAT NASA APPLY THEIR EXPERTISE IN ADVANCED TECHNOLOGY BENEFICIAL TO THIS SECTOR.

## PROFILES (CONTINUED)

### FIRE FIGHTING - Don Rominger

PROTECTING PERSONS AND PROPERTY FROM THE DEVASTATION OF A WILDLAND FIRE IS AN IMMENSE AND COMPLEX PROBLEM. AS A RESULT OF LONG WINTER RAINS AND SNOW, GRASSLANDS AND FORESTS GROW THICK WITH VEGETATION, AND AFTER ONLY A FEW WEEKS OF WARM SUMMER WINDS THIS VEGETATION DRIES OUT AND BECOMES A HIGHLY COMBUSTIBLE FUEL. AN UNCHECKED FIRE UNDER THESE CONDITIONS CAN RACE ACROSS THE COUNTRYSIDE AT OVER 80 MILES PER HOUR, LITERALLY DEVOURING THOUSANDS OF ACRES OF GRASS, PRAIRIES, TIMBER, AND HOMES. IN RECENT YEARS, WILDLAND FIRES HAVE BURNED HUNDREDS OF THOUSANDS OF ACRES, CAUSING A LOSS OF OVER \$30 MILLION TO THE AMERICAN PUBLIC.

ALTHOUGH WILDLAND FIRE FIGHTING ORGANIZATIONS HAVE DONE THE BEST THEY CAN WITH THEIR CURRENT EQUIPMENT, WHAT THEY HAVE BEEN ABLE TO DO, AS THE FIGURES POINT OUT, IS INADEQUATE. THE LOSSES ARE JUST TOO HIGH. IT IS EXTREMELY DIFFICULT TO STOP A TYPICAL WILDLAND FIRE ONCE IT EXCEEDS A FEW ACRES BY UTILIZING CURRENT TECHNOLOGY LITERALLY. CURRENT WILDLAND FIRE FIGHTING TECHNOLOGY CAN ONLY HOPE TO ASSIST NATURE IN STOPPING SUCH FIRES. MEANWHILE, HUMAN LIVES AND COUNTLESS BILLIONS OF DOLLARS ARE LOST AS THE ENVIRONMENT IS DESTROYED.

THE UNDERLYING REASON FOR THIS INADEQUACY IS THAT FIRE FIGHTERS ARE FORCED INTO UTILIZING EQUIPMENT, SPECIFICALLY AIRCRAFT, IN A MANNER FOR WHICH THEY WERE NOT DESIGNED.

ORGANIZATIONS LIKE THE U.S. FOREST SERVICE, CALIFORNIA DEPARTMENT OF FORESTRY, OR THE BUREAU OF LAND MANAGEMENT INHERENTLY RECOGNIZE THE POTENTIAL OF AIRCRAFT FOR COMBATING WILDLAND FIRES. THAT IS WHY THEY HAVE ATTEMPTED TO ADAPT AIRCRAFT ORIGINALLY DESIGNED AS AIRLINERS, CORPORATE HELICOPTERS, AND WORLD WAR II HIGH ALTITUDE BOMBERS TO THE FIRE FIGHTING MISSION. THESE AIRCRAFT HAVE HELPED; LOSSES WOULD BE FAR GREATER WITHOUT THEM.

HOWEVER, CURRENT AIRCRAFT ARE TOO SLOW, TOO SMALL, WITH LIMITED PAYLOAD AND VOLUME, UNDERPOWERED, AND TURN-AROUND TIMES ARE TOO LONG. THE NEED FOR IMPROVED LANDING AREAS IS TOO RESTRICTIVE. ALSO, THE DEMANDS PLACED ON THE PILOT ARE TOO HIGH.

HELICOPTERS, ALTHOUGH THEY INITIALLY APPEAR TO BE MORE EXPENSIVE TO ACQUIRE AND OPERATE THAN CONVENTIONAL GROUND VEHICLES, ACTUALLY RESULT IN A SIGNIFICANT REDUCTION IN COST TO THE WILDLAND FIRE FIGHTER.

## PROFILES (CONTINUED)

### FIRE FIGHTING (CONTINUED)

HOWEVER, THE GROUND VEHICLE (FIRE ENGINE) TAKES SIGNIFICANTLY LONGER TO RESPOND BECAUSE IT MUST FOLLOW A CIRCUITOUS ROUTE OVER MOUNTAINOUS ROADS AT SLOWER SPEEDS. THUS, THE FIRE IS MUCH LARGER BY THE TIME THE FIRE ENGINE ARRIVES; THEREFORE, A LARGE NUMBER OF FIRE ENGINES AND PERSONNEL ARE REQUIRED TO STOP IT. FIRE ENGINES MUST UTILIZE ONLY THE RESOURCES THEY HAVE ON BOARD BECAUSE THE TRAVEL TIME INVOLVED PROHIBITS THE SHUTTLING IN OF ADDITIONAL PERSONNEL AND EQUIPMENT. ASSURING SUFFICIENT RESOURCES WOULD REQUIRE MORE FIRE ENGINES TO BE PURCHASED.

ALL FACTORS CONSIDERED, IT COSTS MORE FOR NUMEROUS FIRE ENGINES TO SPEND MANY HOURS FIGHTING A LARGE FIRE THAN FOR ONE HELICOPTER TO FLY GENERALLY LESS THAN ONE HOUR TO SUPPRESS A STILL SMALL FIRE.

THIS IS BECAUSE THE HELICOPTER IS NOT HINDERED BY THE TERRAIN OR LACK OF ROADS. UTILIZING THE HELICOPTER'S GREATER SPEED AND DIRECT ROUTES TO THE FIRE, THE HELICOPTER CAN PLACE LARGE NUMBERS OF FIRE FIGHTERS ON THE FIRE, AND THEN IMMEDIATELY BACK THEM UP WITH VIRTUALLY UNLIMITED AMOUNTS OF WATER PLACED WITH PINPOINT ACCURACY. THUS, MOST FIRES TO WHICH HELICOPTERS RESPOND ARE STOPPED WITHIN A FEW ACRES.

NEW ADVANCED TECHNOLOGY AIRCRAFT ARE NEEDED. GIVEN AIRCRAFT WITH SUBSTANTIALLY GREATER CAPABILITIES AND PERFORMANCE, THE WILDLAND FIRE CAN BE STOPPED, THOUSANDS OF LIVES AND BILLIONS OF DOLLARS SAVED, AND THE ENVIRONMENT PRESERVED.

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## PROFILES (CONTINUED)

### DISASTER RELIEF - Working Group Chairmen

DISASTER CAN STRIKE AT ANY TIME IN ANY LOCATION THROUGHOUT THE UNITED STATES. DISASTER CAN COME IN MANY FORMS FROM NATURAL TO MAN-MADE: FLOODS, EARTHQUAKES, HURRICANES, BLIZZARDS, TORNADOES, AIRCRAFT CRASHES, CHEMICAL EMERGENCIES, AND CIVIL DISORDERS.

THE LOSS OF PROPERTY USUALLY CANNOT BE REDUCED INITIALLY BUT THE LOSS TO HUMAN LIFE CAN BE GREATLY REDUCED BY RAPID RESPONSE OF PUBLIC SERVICE HELICOPTERS.

THE INITIAL RESPONSE COMES FROM: POLICE, EMERGENCY MEDICAL SERVICES, AND SEARCH AND RESCUE. THE HELICOPTER ALSO PROVIDES AN AIRBORNE PLATFORM FROM WHICH TO COORDINATE THE DISASTER RELIEF UNITS.

THE FIRST HELICOPTER ON THE SCENE PERFORMS THE IMMEDIATE LIFE-SAVING RESCUES AND SUMMONS OTHER PUBLIC SERVICE AIRCRAFT TO ASSIST. THE POLICE HELICOPTER ROUTES THE FIRE AND RESCUE UNITS THROUGH THE PASSABLE ROADWAYS FOR A MORE EFFECTIVE AND RAPID RESPONSE.

THE EMS HELICOPTER BRINGS ADDITIONAL MEDICAL PERSONNEL AND SUPPLIES TO AUGMENT THE AREA'S MEDICAL FACILITIES. IT WOULD THEN RESPOND INTO THE HEART OF THE AREA WITH A MEDICAL TEAM TO TREAT VICTIMS AND PROVIDE THEM WITH HELICOPTER TRANSPORT TO HOSPITALS.

THE SEARCH AND RESCUE AIRCRAFT TRANSPORTS RESCUE TEAMS TO EXTRACT TRAPPED VICTIMS AND TRANSPORT VICTIMS TO MEDICAL FACILITIES.

THE FIRE AIRCRAFT ASSISTS BY EXTINGUISHING FIRES AND AIDS WITH EXTRACTION OF VICTIMS.

WHEN THE IMMEDIATE LIFE-SAVING NEEDS ARE MET, THE PUBLIC SERVICE HELICOPTERS, POLICE, EMS, SAR, FIRE, AND MILITARY COMBINE THEIR EFFORTS TO AIRLIFT VITAL FOOD AND SUPPORT EQUIPMENT.

PAST EFFORTS HAVE PROVEN THAT THE PUBLIC SERVICE HELICOPTER HAS BECOME ONE OF THE IMPORTANT ELEMENTS OF DISASTER RELIEF.

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## THE MAGNITUDE OF THE TECHNOLOGY NEEDS PROBLEM

AS DISCUSSED PREVIOUSLY, FOUR INDIVIDUAL WORKSHOP PANELS MET FOR SEVERAL SESSIONS EACH. EACH WORKSHOP PANEL WAS DEDICATED TO A SPECIFIC AREA OF PUBLIC SERVICE HELICOPTER APPLICATIONS, NAMELY:

- 0 SEARCH AND RESCUE
- 0 EMERGENCY MEDICAL SERVICES
- 0 ENVIRONMENTAL CONTROL AND FIRE FIGHTING
- 0 LAW ENFORCEMENT AND PUBLIC SAFETY

IN EACH OF THESE INDIVIDUAL APPLICATION-ORIENTED WORKSHOP PANELS, THE PARTICIPANTS CONSIDERED AND DEVELOPED THEIR REQUIREMENTS FOR THE OVERALL CHARACTERISTICS OF A HELICOPTER SPECIFICALLY CONFIGURED FOR THEIR PUBLIC SERVICE APPLICATION AS CATEGORIZED IN EIGHT (8) TECHNOLOGY AREAS. TABLE I PRESENTS AN OVERALL SUMMARY OF THE RESULTS AND CONCLUSIONS OF THESE PANELS. THE OPERATING PROBLEMS DEFINING THESE NEEDS ARE CONTAINED IN APPENDIX B. HOWEVER, A FEW EXPLANATORY REMARKS REGARDING TABLE I SHOULD BE INTRODUCED AT THIS TIME.

TABLE I SUMMARIZES THE NUMBER OF INDIVIDUAL PROBLEM ELEMENTS THAT WERE IDENTIFIED FOR EACH OF THE EIGHT TECHNOLOGY AREAS ORIGINALLY POSTULATED. THIS TABLE THUS PRESENTS AN OVERVIEW OF WHERE EACH WORKSHOP PANEL FELT THAT RESEARCH OR DEVELOPMENT ACTIVITY WAS, IN THEIR VIEW, WARRANTED. THIS IS THE FIRST INDICATION OF THE RELATIVE PRIORITY, IN SHEER NUMBERS ONLY, OF WHERE CURRENTLY AVAILABLE PUBLIC SERVICE HELICOPTERS ARE DEFICIENT.

SOME EXPLANATION IS NECESSARY IN ORDER TO EFFICIENTLY INTERPRET THE INFORMATION OF TABLE I. AN EXAMINATION OF APPENDIX B, WHICH PRESENTS THE DATA TRANSCRIBED FROM THE DELIBERATIONS OF EACH WORKSHOP PANEL, INDICATES MANY OF THE PROBLEM ELEMENTS IDENTIFIED IN ANY ONE TECHNOLOGY AREA WERE COMMON BETWEEN DIFFERENT APPLICATION PANELS. FOR INSTANCE, OF THE FIFTEEN (15) VEHICLE DESIGN PROBLEMS IDENTIFIED BY THE EMERGENCY MEDICAL SERVICES (EMS) PANEL, PERHAPS EIGHT (8) ARE EQUIVALENT OR IDENTICAL WITH THE TWELVE (12) PROBLEMS IDENTIFIED IN THE VEHICLE DESIGN TECHNOLOGY AREA BY THE SEARCH AND RESCUE (SAR) PANEL. IN OTHER CASES, MANY OF THE ITEMS CATEGORIZED AS AUXILIARY SYSTEMS ARE UNIQUE TO EACH SPECIFIC APPLICATION.

THUS, ONE CANNOT AUTOMATICALLY ADD ALL THE VEHICLE DESIGN TECHNOLOGY AREAS FROM TABLE I AND GET THE TOTAL NUMBER OF VEHICLE DESIGN PROBLEM TECHNOLOGY AREAS IDENTIFIED BY THE WORKSHOP AS A WHOLE. DETAILED INTERPRETATION OF APPENDIX B IS NEEDED FOR THAT PURPOSE.

SIMILARLY, THE SUM OF ALL THE PROBLEMS IDENTIFIED BY ALL OF THE WORKSHOP PANELS IN TOTALITY CONTAINS SOME COMMONALITY OF PROBLEMS BETWEEN APPLICATION AREAS, AS WOULD BE EXPECTED. THE FOLLOWING SECTIONS OF THIS DOCUMENT IDENTIFY A SUMMARY OF THE MAJOR SPECIFIC NEEDS IN EACH TECHNOLOGY AREA THAT WERE CONSIDERED OF IMPORTANCE TO THIS EFFORT. HOWEVER, TABLE I IS OF CRITICAL IMPORTANCE IN THAT IT INTRODUCES AN INITIAL OVERVIEW OF JUST WHERE R&D ACTIVITY OF SOME NATURE IS NEEDED, IN THE OPINION OF THE WORKSHOP PARTICIPANTS.

THESE IDENTIFIED VEHICLE AND TECHNOLOGY NEEDS HAVE NOT BEEN ASSESSED FOR TECHNICAL OR ECONOMIC FEASIBILITY, NOR HAVE TRADE-OFF COMPROMISES BEEN EXAMINED.

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THE MAGNITUDE OF THE TECHNOLOGY NEEDS PROBLEM

TABLE 1  
INDIVIDUAL WORKSHOP SUMMARY RESULTS

<u>TECHNOLOGY AREA</u>	<u>SAR</u>	<u>EMS</u>	<u>ENVIRON.</u>	<u>LAW</u>	<u>ENF.</u>
VEHICLE DESIGN	12	15	13		11
HUMAN FACTORS	4	3	4		7
SAFETY AND RELIABILITY	7	6	5		2
AVIONICS AND FLIGHT SYSTEMS	14	3	1		8
GUIDANCE, NAVIGATION AND FLIGHT CONTROLS	5	2	3		1
MONITORING AND DIAGNOSTICS SYSTEM	7	1	1		1
PROPULSION	4	2	6		2
AUXILIARY SYSTEMS	5	4	4		6
TOTAL	58	36	37		38

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# TECHNOLOGY NEEDS

## 0 VEHICLE DESIGN

1. INCREASED SPEED (300 KT DASH, 30 MIN MAX, 200 KT MAX CONTINUOUS)
2. HIGH 20000 FEET (SINGLE ENGINE)
3. HIGH 10000 FEET (SINGLE ENGINE)
4. TWIN ENGINE
5. ENDURANCE - 4 HOURS
6. 10000 LB MAX G.W.
7. 20' ROTOR DIAMETER
8. ELIMINATE TAIL ROTOR
9. INTERNAL CABIN AREA (60" HIGH X 52" WIDE X 96" LONG)
10. MODULARIZED CABIN
11. PRESSURIZATION\*
12. AUTOROTATION CAPABILITY
13. INTERNAL & EXTERNAL NOISE REDUCTION
14. PILOT OPERATED HOIST
15. COMPATIBLE ELECTRICAL SYSTEM
16. SHUTDOWN POWER CAPABILITY
17. QUICK ACCESS MAINTENANCE
18. WATER/RETARDANT CAPABILITY
19. IMPROVED ALL TERRAIN LANDING GEAR
20. IMPROVED VISIBILITY
21. IMPROVED MANEUVERABILITY
22. SLIDING CARGO DOOR
23. INTERNAL ACCESS TO CARGO CABIN
24. EQUIPMENT STORAGE
25. COLD INTERIOR LIGHTING
26. HOT REFUELING CAPABILITY

\* OPTIONAL

## 0 PROPULSION

1. NON-PETROLEUM FUELS
2. MULTIPLE FUEL CAPABILITY
3. LOW FUEL CONSUMPTION
4. DUAL POWER BAND
5. INCREASED SHAFT HP
6. LIGHTWEIGHT POWER PLANT
7. EMERGENCY POWER CAPABILITY
8. PARTICLE SEPARATORS (FOD PROOF)
9. MAIN ROTOR CLUTCH
10. MINIMAL WARM-UP TIME

## 0 SAFETY & RELIABILITY

1. CRASHWORTHY STRUCTURE
2. CRASHWORTHY SEATS
3. CRASHWORTHY FUEL SYSTEM
4. ELIMINATE DYNAMIC ROLL-OVER
5. IMPROVED RESTRAINT SYSTEM
6. IMPROVED HELMETS
7. IMPROVED EGRESS SYSTEM
8. INCREASED MAIN ROTOR CLEARANCE
9. REDUCED TAIL ROTOR HAZARD (REMOVE TAIL ROTOR)
10. BIRD STRIKE PROTECTION
11. REMOVABLE BALLISTICS PROTECTION & DETECTION
12. FUEL DUMPING CAPABILITY
13. FIRE PROTECTION
14. HAZARDOUS MATERIAL STORAGE

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# TECHNOLOGY NEEDS

## o NAVIGATION/GUIDANCE &

### FLIGHT CONTROLS

1. AUTOMATIC FLIGHT CONTROL
2. COMBINED CONTROLS
3. STABILIZATION
4. ALL WEATHER CAPABILITY
5. LOW AIRSPEED MEASUREMENT
6. ELECTRONIC MAP DISPLAY
7. PRECISION LOCATION/NAVIGATION

## o MONITORING & DIAGNOSTIC

### SYSTEMS

1. IMPROVED SEATS
  2. ENVIRONMENTAL CONTROL
  3. NOISE AND VIBRATION
  4. CONTROL STANDARDIZATION
  5. DUAL CONTROLS
  6. VISIBILITY
  7. INTEGRATED FLIGHT INSTRUMENTS
1. TREND WARNING
  2. COMPUTERIZED MONITORING SYSTEM
  3. WARNING/CAUTION SYSTEM
  4. COLOR CODED ANNUNCIATION
  5. AURAL WARNING
  6. HEAD-UP DISPLAY
  7. PERFORMANCE LIMITATIONS

## o AUXILIARY SYSTEMS

### HOIST LOCATIONS & CAPABILITIES

1. RAPPEL ATTACHMENTS
2. IMPROVED LITTER
3. LITTER SUSPENSION
4. NIGHT VISION SYSTEM
5. IMPROVED SEARCHLIGHT
6. OPTICAL EQUIPMENT
7. PHOTO/TV EQUIPMENT
8. ON-BOARD APU
9. A/C VISUAL IDENTIFICATION
10. CAR IDENTIFIER
11. CAR LOCK-ON
12. CAR STOPPER
13. TOWING EQUIPMENT
- 14.

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NASA'S MISSION  
AND ROLE IN PUBLIC SERVICE  
ROTORCRAFT RESEARCH

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- 0 APPLY R&T \$ TO SERVE THE TAXPAYER
- 0 PROVIDE TECHNOLOGY NEEDED TO REDUCE COSTS
- 0 STIMULATE MANUFACTURER THINKING
- 0 ESTABLISH RESEARCH/OPERATOR FEEDBACK LOOP
- 0 DEVELOP OPERATIONAL EVALUATIONS TO DEMONSTRATE THROUGH PROTOTYPE DIRECT TECHNOLOGY BENEFITS TO SOCIETY

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THE CONSENSUS OF THE WORKING GROUP CHAIRMEN WAS THAT CONTINUING NASA/OPERATOR  
INTERCHANGES ARE CRITICAL TO THE ESTABLISHMENT OF RESEARCH AND TECHNOLOGY  
PROGRAMS RESPONSIVE TO PUBLIC SERVICE OPERATOR NEEDS

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